

## 8.0

### EVALUATION OF THE USEABILITY OF HISTORIC BATHYMETRIC SURVEY DATA

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In accordance with SOW Section B.3.a.iv, this section provides an evaluation of the usability of historic bathymetry data for the Passaic River Study Area (Site). This section reviews the criteria on which the historic bathymetry were evaluated and the results of the evaluation. The bathymetry provides the best resource to use for calibration of sediment mobility modeling and for selection of time stratigraphic intervals for chemical characterization.

#### 8.1 OVERVIEW OF BATHYMETRIC SURVEYS

The Passaic River, Hackensack River and Newark Bay have been used for barge and boat traffic for many years; hence navigation lanes have been maintained. USACE is responsible for keeping the lanes dredged to specified project depths. One use of bathymetry by the USACE is to indicate the condition of the river and hence the amount of sediment that needs to be periodically dredged. Bathymetry data are also available for some time periods when the river was not to be dredged. Specifically, bathymetric surveys estimate the depth of water in a waterway by collecting depth measurements and horizontal control data.

Historical bathymetric surveys are available for the Site and were obtained from the USACE - New York District. The USACE stores each bathymetric survey sheet on aperture cards. An aperture card is a fiche-like storage device that contains the image of a bathymetric survey sheet which can be read by a large copier-type printer. The copies produced by the printer are not to the original scale and were enlarged to the scale indicated on the original bathymetric survey sheet.

## 8.2 CRITERIA FOR EVALUATING BATHYMETRIC SURVEYS

Bathymetric survey sheets containing depth information in the vicinity of the lower Passaic River were reviewed for usefulness. The bathymetry sheets were evaluated based on the following criteria:

- a clear, readable copy from the USACE<sup>1</sup>
- clearly defined datum planes
- good survey coverage (i.e., density of survey lines no more than 250 feet apart for a given survey)
- a scale suitable for digitization

A final selection of the 79 survey sheets, based upon the criteria described above, is discussed in more detail in Section 8.3.

## 8.3 PASSAIC RIVER STUDY AREA COVERAGE

A total of 373 bathymetric survey sheets for the lower Passaic River were obtained from the USACE. An inventory of all sheets received is presented in Appendix B (Table B-1). Included within this table are also survey location information, whether or not it passed the selection criteria given in Section 8.2, and the reason for failure to pass (if pertinent). Some of these sheets were base maps or range maps and did not include any

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<sup>1</sup>A clear copy could not always be obtained. The USACE stores historical bathymetric surveys on an aperture card (fiche). These cards must be read and paper copies generated in a unique printer. The subsequent copy must then be enlarged to the appropriate scale. If the original aperture card image is questionable, the generated image from the printer may not be readable.

sounding (depth of water) information. These sheets were eliminated from consideration as not providing good survey coverage. An area of interest was selected which represents the area to be modeled in the sediment mobility evaluation (Section 7.0) and encompassed the Passaic River Study Area plus one mile upstream of the upstream boundary. The bathymetry data will be used for calibration and verification of sediment modeling results. The sheets which did not contain bathymetric data within this area were eliminated from consideration as not being relevant to the work to be conducted under this RIWP. Of the 150 sheets which were considered as being relevant to the work, 26 sheets were eliminated for failure to meet one or more of the criteria specified in Section 8.2, leaving 124 sheets as being considered to be useable in meeting the objectives of the RIWP. These sheets are denoted as "A" for the Class of Map column in Table B-1.

Bathymetric survey data were used in preparing this RIWP was in selecting time stratigraphic intervals to be utilized in determining sampling intervals for use in the chemical characterization of the sediments (Section 5.0). Since most of the Passaic River Study Area was dredged in 1949, and since the earliest sediments of interest in the sediment characterization are those from the 1940s, only surveys that were performed subsequent to the 1949 dredging event were selected for use in evaluation of the sedimentation history within the Site boundaries. Of the 124 sheets considered as useable, 79 represented post-1949 dredging surveys. These 79 sheets are summarized in Table 8-1 as a function of the year that the survey coverage was obtained. Figure 8-1 presents a graphical summary of the survey coverage represented by these sheets. The lower 7000 feet of the Passaic River Study Area was dredged as recently as 1983. As such, for this area only post dredging surveys were selected for use in delineating time stratigraphic intervals as detailed in Section 5.2.3.2. These were the surveys conducted in 1986, and 1989. For the rest of the Passaic River Study Area, the most recent dredging was in 1949. Of the post dredging surveys conducted within this portion of the Passaic River Study Area, five surveys were selected as providing the most complete

coverage (1949, 1966, 1976, 1986, 1989). None of the other surveys provided coverage for more than 25% of the Site.

#### **8.4 EVALUATION OF ACCURACY OF REPORTED HISTORIC DATA**

The surveys selected as both useable and relevant to meeting project objectives were evaluated on the estimated accuracy of the sounding information at each of the locations selected for taking a core sample to be used in the chemical characterization of sediments in the Site. The accuracy evaluation included the following procedures;

- Historic information obtained from the USACE and from interviews with USACE personnel were utilized to evaluate the position uncertainty associated with methods of collecting sounding locations. The equipment and the methodology used for obtaining location information were examined in detail to provide an estimate of the relative accuracy of each survey. The 1986 and 1989 surveys used either laser- or microwave-based electronic distance measuring devices with a much higher degree of accuracy than the manual methods of triangulation from known landmarks and surveyed in survey line endpoints used in earlier surveys. An estimate of error was made based on the error expected for each of these devices.
- Positions were recalculated from raw data in the USACE field note books and compared to the location plotted on the USACE maps for representative data sets covering twenty survey lines using the manual positioning systems. A comparison of the recalculated and plotted locations allowed a numeric estimation of the error associated with calculating and plotting positions from the measured data used in the 1966 and 1976 surveys.

- A review of aerial photos was utilized to evaluate shoreline positions during the time of the bathymetric surveys. This permitted the evaluation of a few of the surveys on which it appears that soundings were apparently taken on shore when plotted on a map containing present river boundaries.
- Multiple independent generation of x,y coordinates from bathymetric survey sheets was performed to evaluate the precision with which one could obtain coordinates from plotted locations. A numeric estimate of error was obtained from the calculated variation.

From the numerous estimates of uncertainty from each of the above-described items, an estimate of total horizontal error was calculated for each survey. There is an associated vertical uncertainty related to these locations. Vertical errors were calculated based on the estimated slope of the sediment surface at the sampling location, multiplied by the horizontal error associated with a given survey event. The combination of position and vertical uncertainty becomes a factor in selecting time interval samples in areas of the river where the river bottom is steeply sloped. Thus, the primary uncertainty in the bathymetry for selecting time interval samples affects only those cores placed in locations where the channel bed is steeply sloped. Outside of these areas the degree of uncertainty is relatively low. Also, the use of bathymetry for evaluating sediment mobility modeling results will be primarily affected by this uncertainty for areas of the river which are steeply sloped.

Figure 8-2 presents an example of a stick diagram portraying the sediment depths corresponding to each of the selected bathymetric surveys. The estimated error limits associated with each survey depth are presented as the dashed lines of the same color as the surveyed depth. Appendix A contains analogous stick diagrams depicting the bathymetric survey depths and associated uncertainty in depth for all 78 vibracore

sampling locations. These data were utilized in selecting the time stratigraphic horizons as discussed in detail in Section 5.0.

**TABLE 8-1**  
**SUMMARY OF USEABLE BATHYMETRY COVERAGE**  
**FOR THE SITE VICINITY**

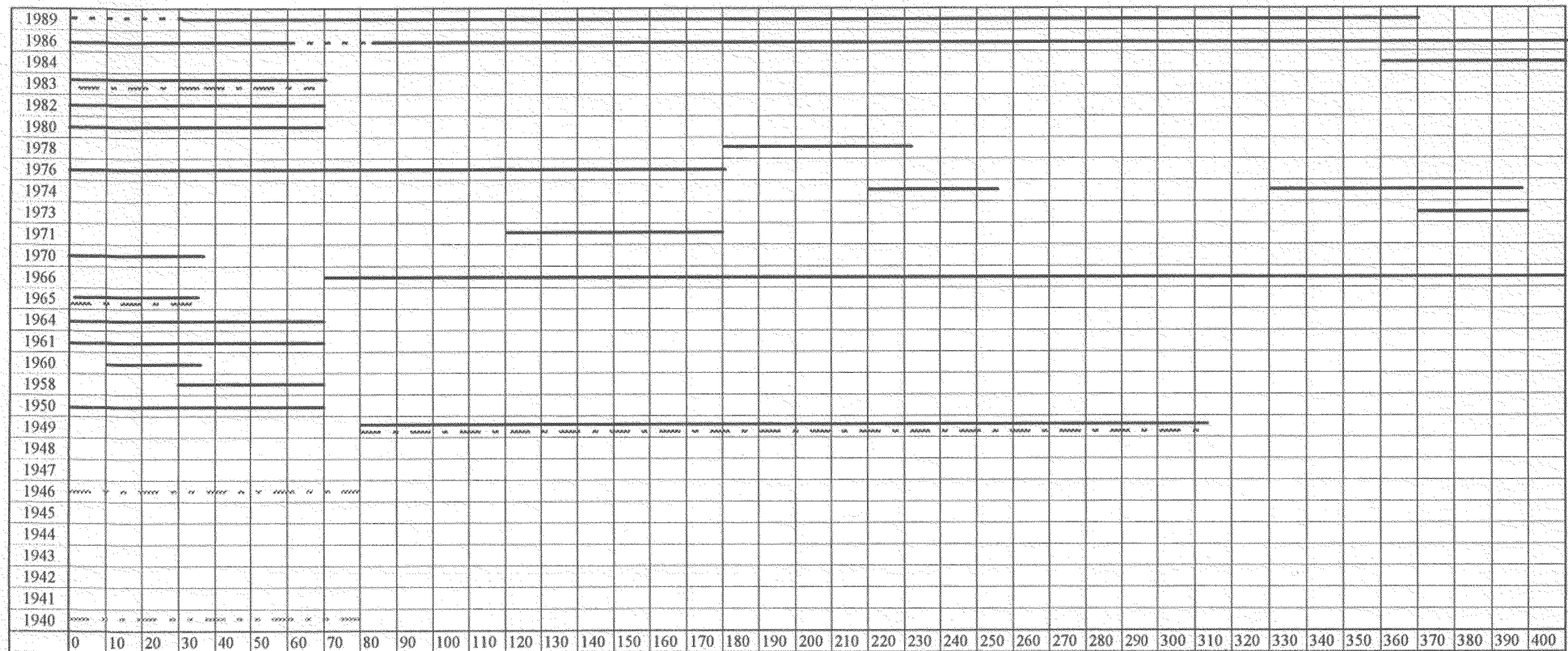
**Passaic River Study Area, New Jersey**

Year Bathymetric Survey Was Performed	Number of Useable Survey Sheets
1989	12
1986	12
1984	1
1983	7
1982	2
1980	2
1978	1
1976	4
1974	4
1973	1
1971	1
1970	4
1966	4
1965	3
1964	3
1962	2
1961	2
1960	1
1958	1
1950	3
1949	9
<b>Total</b>	<b>79</b>

FIGURE 8-1

USEABLE BATHYMETRY COVERAGE AND DREDGING HISTORY FOR THE SITE

Passaic River Study Area, New Jersey



Abandoned ConRail Bridge

Approximate Upper Limit  
of the 30-foot Project Depth

End of 6-Mile  
Study Area

Approximate Upper Limit  
of the 16-foot Project Depth

Approximate Upper Limit  
of the 20-foot Project Depth

Second  
River

Notes: - - - - Sheets exist but were deemed not usable  
Better copies have been requested from USACE

———— Dredged areas (identified in Table A-1)  
Bathymetry Coverage

~~~~~ Dredge event based on  
previous reports

~ Sediment Core Position Centerline

**Surfaces**

~ 1949 Post-dredge

~ 1966

~ 1976

~ 1986

~ 1989

**Error Surfaces**

~ 1949 Post-dredge

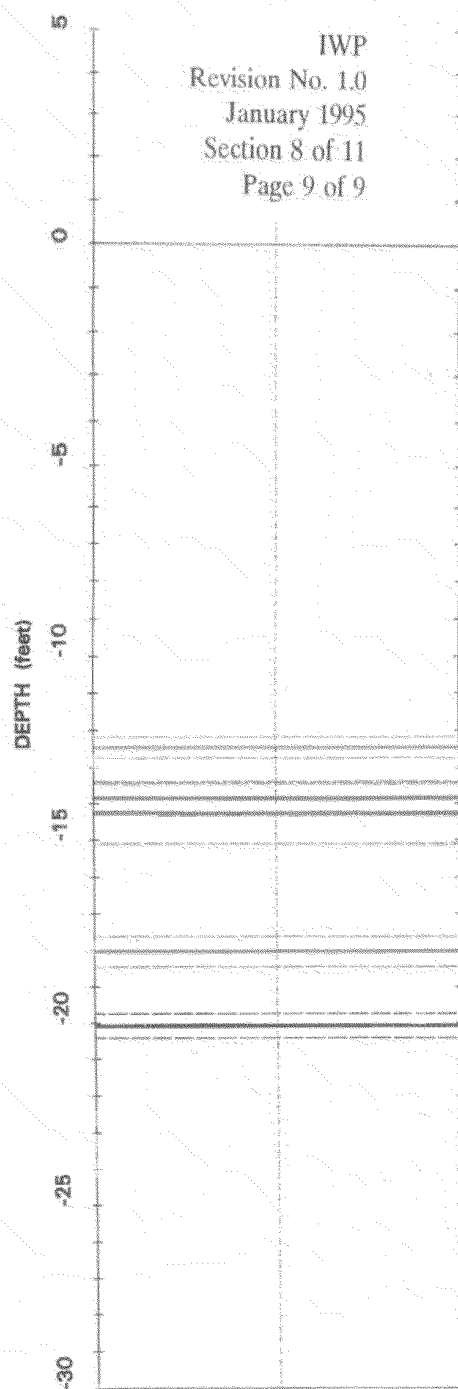
~ 1966

~ 1976

~ 1986

~ 1989

DEPTHS REFERENCE MLW  
VERTICAL SCALE: 1 in. = 5 ft.



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**EXAMPLE CORE BORING  
SHOWING ERROR  
(UNCERTAINTY) SURFACES**

FIG. 8-2